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Description

Parking Brake Lock

Background of Invention

[0001] This invention relates to a locking mechanism to retains a clamping force that holds first and second friction members into engagement with a rotor to sustain a park brake application.

[0002] It was common for vehicles to have disc brakes on the front wheels and drum brakes on the rear wheels; however, currently it is common to have disc brakes on all four wheels. This requires a revision to the parking brake structure in the absence of drum brakes. A common type of park brake used with rear calipers are drum-in-hat brakes is disclosed in U.S. Pat. No. 5,180,037, integral piston brakes disclosed in U.S. Pat. No 5,038,895 or a separate brake as disclosed in U.S. Pat. No. 5,921,354. All of these types of brakes require an input force from an operator applied through a lever to mechanically move friction members into engagement with a rotor or drum associated with a wheel to effect a parking brake applica-

tion. Theoretically hydraulic pressure could be used to engage friction members with a rotor or drum, but hydraulic systems can leak and as a result of such a leak the clamping force may released thereafter allowing the vehicle to move on an inclined surface. In addition, federal regulations do not allow purely hydraulic means for holding park brake applications and require a mechanical means to hold park brake applications and thereby lock the wheels. While the current federal regulations do not prohibit using hydraulic pressure to effect a parking brake application a mechanical backup must be provided for sustaining parking.

SUMMARY OF INVENTION

[0003] A primary purpose of the present invention is to provide a mechanical means to hold a park brake in an applied position after hydraulic pressure was used to initiate the park brake apply even after hydraulic pressure is removed.

[0004] The disc brake according to the present invention has a support member secured to a vehicle. The support member has first and second guides to align a caliper over a rotor associated with a wheel of a vehicle. The caliper has an actuation section connected by a bridge to an arm. The

actuation section has a bore therein for retaining a piston to define an actuation chamber. A first friction member is connected to the arm on one side of the rotor and a second friction member is connected to the piston on the other side of the rotor so that the two friction members are aligned with each other on opposite sides of the rotor. The piston is prevented from rotating with respect to the second friction member by anti rotation members engaged with the piston. Pressurized fluid is presented to the actuation chamber which acts on the piston to develop a dynamic clamping force that urges the first and second friction members into engagement with the rotor to effect a brake application. The pressurized fluid has a predetermined pressure, which is sufficient to generate enough clamping force to lock the rotors associated with the wheels of a vehicle when the vehicle is on an incline.

[0005] An advantage of the disc brake provided by the present invention resides in the ability to maintain a static clamp force to engage friction members with a rotor in the absence of pressurized fluid.

[0006] A further advantage of the present invention resides in a locking mechanism that conforms to current federal parking brake regulations since it does not depend on hy-

draulic pressure to maintain a park brake apply.

Brief Description of Drawings

[0007] Figure 1 is a schematic illustration of a disc brake made according to the present invention;

[0008] Figure 2 is a sectional view taken along line 2-2 of Figure 1;

[0009] Figure 3 is a sectional view of the disc brake in Figure 1 with a piston in an actuated position; and

[0010] Figure 4 is a sectional view of locking means that holds the piston in the actuated position to effect a parking brake application.

Detailed Description

[0011] The disc brake *10* as shown in *FIGS. 1 and 3* is utilized as a service brake and a parking brake in a vehicle and includes a locking mechanism *11* of the present invention. The locking mechanism *11* holds a first friction member *12* and a second friction member *13* into engagement with a rotor *14* during a park brake application.

[0012] The disc brake *10* has a housing that includes an actuation section *15* connected by a bridge *16* to an arm *17*. The actuation section *15* has a bore *18* therein with a piston *19* to define an actuation chamber *20*. The actuation chamber *20*

also retains a locking mechanism *11*. The first friction member *12* is connected to the arm *17* while the second friction member *13* is connected to piston *19* so that the first *12* and second *13* friction members are aligned on opposite sides of the rotor *14*. The rotor *14* rotates with the wheel of a vehicle. During a brake application pressurized fluid is introduced into the actuation chamber *20* to exert a force on the piston *19*. The force exerted on the piston *19* moves the second friction member *13* into engagement with the rotor *14* and the force is transmitted through the bridge *16* to the arm *17* which pulls the first friction member *12* into engagement with the rotor *14* to generate a clamping force. The clamping force can be selectively established by changing the pressure in fluid introduced into the actuation chamber *20* to effect a service brake apply for stopping a vehicle or maintained by the locking mechanism to affect a park brake apply.

[0013] The locking mechanism *11* is located within the actuation chamber and defined by a first threaded member *21* that is integrally attached to piston *19*, a second threaded member *23* that rotates on first threaded member *21* by threads that mate with the first threaded member *21*, and a bearing section *36*. The bearing section *36* includes a

snap ring *24* that is retained in a groove *25* in bore *18* wherein a preloaded wave washer *26* exerts against snap ring *24* and bearing washer *27*. The bearing washer is urged against a first thrust bearing *28*. The first trust bearing *28* presses against a first surface *29* on the second threaded member *23* to urge a second surface *30* thereon against a second trust bearing *31* positioned at the bottom of bore *18*. The second threaded member *23* is able to rotate on the first threaded member *21* and has no lash threads that mate with the first threaded member *21*. The first threaded member *21* moves forward with the piston *19* while the second threaded member *23* is restrained from moving forward. This restraint allows the second threaded member *23* to rotate within the actuation chamber *20*. The first threaded member *21* is limited to linear movement as it is prevented from rotating with respect to the bore *18* by anti rotation members *22* (raised buttons on the backing plate) on the second friction member *13*. The locking mechanism *11*, as shown in Figure 2,further includes a plunger *32* that is moved by a solenoid *36* to bring teeth 33 on the plunger *32* into engagement with teeth 34 on the second threaded member *23* when a park brake application is desired. The solenoid 36 could be re-

placed with a shaft that is moved by a manual input to being teeth 33 into engagement with teeth 34 to define the locking position.

MODE OF OPERATION

[0014] When a vehicle is moving the disc brake *10* is in off brake position as illustrated in Figure 1, with the first *12* and second *13* friction members are separated from the rotor *14* by a small distance. When an operator of a vehicle that includes a disc brake *10* desires to stop the vehicle, an input force is applied to a brake pedal and a control valve is actuated to supply hydraulic fluid from a remote source to the actuation chamber *20*. The pressurized hydraulic fluid in the actuation chamber *20* acts on piston *19* to exert a separation force, that extends the piston toward the rotor *14* to engage the second friction member *13* with a first face *14a* of the rotor *14*. After second friction member *13* has contacted the first face *14a* of the rotor *14* the force is transmitted through the bridge *16* to the arm *17* which pulls the first friction member *12* into contact with a second face *14b* of the rotor *14*. As the first *12* and second *13* friction members move to close the gaps *X1* and*X2* with the rotor the piston extends from the bore *18* a distance equal to the sum of *X1* and *X2* to fully extend the piston in

a brake apply as illustrated in Figure 3. As piston *19* moves to the fully extended position, a first threaded member *21* which is integrally attached to piston *19* also advances with the piston *19* in bore *18*. The piston *19* and first threaded member *21* are prevented from rotating with respect to the second friction member *13* by the engagement of anti rotation members *22* with piston notches *60*. The second threaded member *23* is able to rotate on first threaded member *21* and has no lash threads that mate with first threaded member *21*. As first threaded member *21* moves forward with piston*19*, the second threaded member *23* is restrained from moving forward which causes the second threaded member *23* to rotate.A brake application may be sustained by the locking mechanism *11* to effect a parking brake application. With the fluid pressure in chamber *20* and the piston *19* extended, a signal is provided to solenoid *36* to move plunger *32* and bring teeth *33* into engagement with teeth *34*, as shown in *FIG 4*. When teeth *33* are engaged with teeth *34* on the second threaded member *23* rotation is prevented, which prevents linear movement of first threaded member *21*, which is integrally connected to piston *19* and prevents return movement of the piston from the extended posi-

tion shown in *FIG. 3* to the rest position of*FIG. 1*. Since the second threaded member *23* is prevented from rotating due to engagement with the plunger *32* pressurized fluid in chamber is no longer necessary to hold the extended position as shown in *FIG. 3*. Thus it is possible that the fluid pressure in chamber *20* may be eliminated and the clamping force is sustained until released by the operator. To release the parking brake application the operator introduces high pressure fluid to chamber *20* which acts on piston *19* and the teeth *33* are thereafter retracted from engagement and allows return of the piston to the rest position of *FIG. 1* and release of the friction members from engagement as seen in *FIG. 1*.